

FM 6-65

WAR DEPARTMENT

**FIELD ARTILLERY
FIELD MANUAL**

SERVICE OF THE PIECE

75-MM GUN, M1917A1, TRUCK-DRAWN

FM 6-65

**FIELD ARTILLERY
FIELD MANUAL**



**SERVICE OF THE PIECE
75-MM GUN, M1917A1, TRUCK-DRAWN**

**Prepared under direction of the
Chief of Field Artillery**



**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1939**

For sale by the Superintendent of Documents, Washington, D. C. - Price 10 cent

WAR DEPARTMENT,
WASHINGTON, *October 1, 1939.*

FM 6-65, Field Artillery Field Manual, Service of the Piece—75-mm Gun, M1917A1, Truck-drawn, is published for the information and guidance of all concerned.

[A. G. 062.11 (6-17-39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

TABLE OF CONTENTS

	Paragraph	Page
SECTION I. General:		
Purpose and scope.....	1	1
References.....	2	1
Definitions and terms.....	3	1
SECTION II. Organization.		
Composition.....	4	2
Formation.....	5	2
SECTION III. Posts; mounting and dismounting:		
Posts of the gun squad.....	6	3
To post the gun squads.....	7	3
Posts of the cannoneers.....	8	3
To post the cannoneers.....	9	4
To mount the cannoneers.....	10	4
To dismount the cannoneers.....	11	5
SECTION IV. Movement of the carriages by hand:		
Coupled.....	12	5
Uncoupled.....	13	5
SECTION V. Uncoupling and coupling:		
Uncoupling.....	14	6
Coupling.....	15	7
SECTION VI. Preparation for action and march order:		
To prepare for action.....	16	7
Posts of the cannoneers, pieces uncoupled.....	17	9
March order.....	18	10
SECTION VII. Duties in firing:		
General.....	19	12
Chief of section.....	20	13
Gunner.....	21	17
No. 1.....	22	23
No. 2.....	23	24
No. 3.....	24	25
No. 4.....	25	27
No. 5.....	26	29
SECTION VIII. Additional information on the service of the piece:		
Accuracy in laying.....	27	29
Fire at will.....	28	30
To fire by individual sections with direct lay- ing at moving targets.....	29	30
Aiming stakes.....	30	31
Correction for lateral displacement.....	31	32
Trail logs and platforms.....	32	32
Reporting errors.....	33	32
Cease firing.....	34	32
Suspend firing.....	35	33
Changes in data during firing.....	36	33
To unload the piece.....	37	33
Misfires.....	38	34
Ammunition.....	39	34
The section data board.....	40	34

TABLE OF CONTENTS

	Paragraph	Page
SECTION IX. Care and maintenance of matériel:		
General	41	35
Cleaning and lubricating.....	42	36
Protection against chemicals.....	43	37
Recoil mechanism.....	44	37
Barrel assembly, breech mechanism, and firing mechanism.....	45	42
Wheels and brakes.....	46	44
Miscellaneous parts of carriage.....	47	45
Sighting and fire-control equipment.....	48	46

FIELD ARTILLERY FIELD MANUAL

SERVICE OF THE PIECE

75-MM GUN, M1917A1, TRUCK-DRAWN

(The matter contained in this manual supersedes TR 430-25, October 18, 1932.)

SECTION I

GENERAL

■ 1. PURPOSE AND SCOPE.—This manual prescribes the duties to be performed in the service of the piece by the personnel normally assigned to one gun section of the firing battery.

■ 2. REFERENCES.—*a. Description, operation, functioning, and care of matériel.*—SNL C-27 and Handbook of the 75-mm Gun Matériel, M1917 (British), February 9, 1918, revised September 6, 1918.

b. Description and operation of fire-control and sighting equipment.—TR 1320-C (now TR 320-20); SNL F-22.

c. Ammunition.—TR 1355-75A; TR 1370-A; SNL R-1; SNL R-3.

d. Cleaning and preserving materials.—SNL K-1; TR 1395-A.

e. Maneuvers of the battery.—Part Two, FM 6-5.

f. Safety precautions in firing.—AR 750-10; Chapter 1, FM 6-40.

g. The firing battery.—Chapter 1, FM 6-40.

h. Gunnery.—FM 6-40.

i. Reconnaissance, occupation, and organization of position.—Part One, FM 6-20.

■ 3. DEFINITIONS AND TERMS.—*a. Section.*—Tables of Organization prescribe the personnel and matériel comprising a section of a battery. In this manual the term is frequently used to designate a section of the firing battery. In this restricted sense, a gun section is composed of one piece and

the additional matériel and the personnel required to serve that piece.

b. Coupled.—A piece is said to be coupled when its lunette is attached to the pintle of a truck or other prime mover.

c. Uncoupled.—A piece is said to be uncoupled when its lunette is detached from the pintle of a truck or other prime mover and the trail rests on the ground.

d. Front.—The front in a section, pieces coupled, is the direction in which the trail points; pieces uncoupled, the direction in which the muzzle of the piece points.

e. Right (left).—The direction right (left) is the right (left) of one facing to the front.

f. In battery.—The term "in battery" is used to designate the position of the gun when it is in its normal firing position.

SECTION II

ORGANIZATION

■ 4. COMPOSITION.—*a. Gun squad.*—A gun squad consists of the gunner and five cannoneers numbered from 1 to 5. The remaining cannoneers of the gun section act as reliefs or are assigned such other duties as the chief of section may direct. When the battery uncouples for drill or for firing, the chief of section remains at the firing position and commands the gun squad.

b. Ammunition squad.—An ammunition squad consists of an ammunition corporal and cannoneers as prescribed in Tables of Organization. These cannoneers are numbered consecutively, beginning with No. 1, and are assigned to the ammunition vehicles of the ammunition (fifth) section. Posts and movements prescribed hereinafter for the gun squad apply, with obvious modifications, to an ammunition squad.

■ 5. FORMATION.—*a. Order of formation.*—A gun squad is formed as shown in figure 1. Higher-numbered cannoneers, if present, form in order on the left of No. 5.

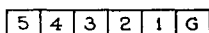


FIGURE 1.—Formation of the gun squad.

b. To form.—(1) The place of formation is indicated and the command given thus, for example: 1. IN FRONT (REAR) OF YOUR PIECES, OR 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Each gunner repeats the command FALL IN and hastens to place himself, faced in the proper direction, at the point where the right of his squad is to rest. The cannoneers move at the double time and assemble at attention in their proper places. For the first formation of the gun squads for any drill or exercise, the caution, "As gun squads," precedes the command. The chief of section, if present, supervises the formation.

(2) In case the front or rear of the carriages is designated, each squad falls in at its post (par. 6).

c. To call off.—(1) The command is: CALL OFF. The cannoneer on the left of the gunner calls off, "One"; the cannoneer on the left of No. 1, "Two"; and so on.

(2) After having called off, if a subsequent formation is ordered, the cannoneers fall in at once in their proper order.

SECTION III

POSTS; MOUNTING AND DISMOUNTING

■ 6. POSTS OF THE GUN SQUAD.—*a. Pieces coupled.*—(1) *In front of the piece.*—The squad is in line facing to the front, its center two paces in front of the truck.

(2) *In rear of the piece.*—The squad is in line facing to the front, its center two paces from the muzzle of the piece.

b. Pieces uncoupled.—The squad is in line facing to the front, its center two paces from the end of the trail of the piece.

■ 7. TO POST THE GUN SQUADS.—The squads having been marched to the vicinity of the pieces are posted at the command SQUADS IN FRONT (REAR) OF YOUR PIECES. Each gunner marches his squad to its piece and posts it in the position indicated.

■ 8. POSTS OF THE CANNONEERS.—*a. Pieces coupled.*—The cannoneers of the gun squad are posted as shown in figure 2. All are 2 feet outside the wheels and facing to the front.

Higher-numbered cannoneers, if present, are posted as prescribed by the chief of section.

b. Pieces uncoupled.—See paragraph 17.

■ 9. To POST THE CANNONEERS.—*a.* The command is: 1. CANNONEERS, 2. POSTS. Each gunner repeats the command POSTS. The cannoneers leave the ranks, if formed, and move at the double time to their posts.

b. For preliminary instruction, the squads on entering the park are first posted with their pieces, and the cannoneers are then sent to their posts by the foregoing command. The command is general, however, and is applicable when the cannoneers are in or out of ranks, at a halt or marching, and when the pieces are coupled or uncoupled.

■ 10. To MOUNT THE CANNONEERS.—*a.* In each gun squad the personnel is seated in the body of the truck in the order prescribed by the battery commander. The chief of section is seated beside the driver.

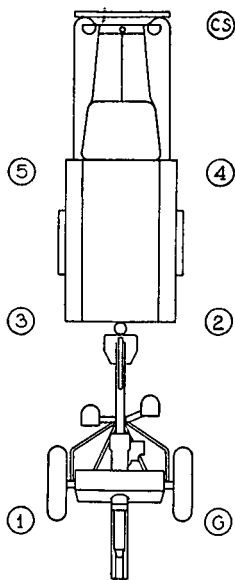


FIGURE 2.—Posts of the cannoneers, piece coupled.

b. The command is: 1. CANNONEERS, PREPARE TO MOUNT, 2. MOUNT. At the first command, the cannoneers move at the double time to positions on the ground convenient for mounting the truck. At the second command, all mount as prescribed by the battery commander.

c. If the command is: 1. CANNONEERS, 2. MOUNT, the cannoneers execute, at the command MOUNT, all that has been prescribed for the commands CANNONEERS, PREPARE TO MOUNT and MOUNT.

■ 11. To DISMOUNT THE CANNONEERS.—a. The command is: 1. CANNONEERS, PREPARE TO DISMOUNT, 2. DISMOUNT. At the first command, the cannoneers assume positions from which they can dismount promptly; at the second command, they jump to the ground and take their posts at the double time.

b. If the command is: 1. CANNONEERS, 2. DISMOUNT, the cannoneers execute, at the command DISMOUNT, all that has been prescribed for the commands CANNONEERS, PREPARE TO DISMOUNT and DISMOUNT.

SECTION IV

MOVEMENT OF THE CARRIAGES BY HAND

■ 12. COUPLED.—The carriages are not moved by hand when coupled.

■ 13. UNCOUPLED.—The command is: 1. PIECES FORWARD (BACKWARD), 2. MARCH, 3. HALT.

a. *First command.*—At the first command, No. 2 places the trail handspike in the traveling position if it is not already there; Nos. 2 and 5 grasp the trail handles, No. 2 on the left, No. 5 on the right; Nos. 1 and 4 place themselves at the breech in moving forward and in front of the shield in moving backward, No. 1 on the right; No. 3 goes to the muzzle; the gunner places himself where he can operate the brakes; higher-numbered cannoneers, if present, are employed as directed by the chief of section.

b. *Second command.*—At the command MARCH, all working together move the piece forward (backward) under the direction of the chief of section. When moving up or down steep slopes, the gunner assists by alternately setting and

releasing the right and left brakes, thus permitting the piece to be pivoted about the locked wheel. At the command **HALT**, they stop the piece, the gunner sets the brakes, and all resume their posts (par. 17).

SECTION V

UNCOUPLING AND COUPLING

■ 14. **UNCOUPLING.**—*a. General.*—At drills, trucks are posted as directed by the battery commander. In active service and in instruction simulating it, the trucks are conducted by the first sergeant to a place previously designated by the battery commander, where they are disposed so as to take the best advantage of cover and concealment. If no cover and concealment are available, they are located in rear of either flank, faced to the front, with wide intervals between them.

b. To fire to the front.—The command is: **ACTION FRONT**. If marching, the trucks halt at the command or signal. The cannoneers, if mounted, dismount after the trucks have halted.

(1) *The piece.*—The gunner and No. 1 hasten to the wheels nearest their respective posts. Nos. 2 and 5 hasten to the trail handles, No. 2 on the right; No. 3 hastens to the muzzle. No. 2 unlatches the pintle and assisted by No. 5 raises the trail from the pintle; Nos. 2 and 5, assisted by No. 1 at the wheel and No. 3 at the muzzle, swing the piece 180° clockwise. Prior to the turn, the gunner sets the brake on the pivot wheel (the wheel adjacent to the gunner's post) and when the turn is completed sets the other brake. Nos. 2 and 5 swing the lunette and secure it in the firing position, then lower the trail to the ground. No. 4 starts unloading ammunition, tools, and accessories from the truck and places them to the left of the piece as directed by the chief of section. When the trail has been lowered to the ground, the gunner and Nos. 1, 2, 3, and 5 assist No. 4 in completing the unloading. When the unloading has been completed, the chief of section commands or signals **DRIVE ON**. The gunner and all cannoneers take their posts (par. 17).

(2) *The trucks.*—At the command **DRIVE ON**, the trucks move out and are conducted by the first sergeant to their previously designated position.

c. To fire to the rear.—The command is: **ACTION REAR**. The movement is executed according to the principles of **ACTION FRONT** except that the pieces are not turned after uncoupling.

d. To fire to the flank.—The command is: **ACTION RIGHT (LEFT)**. The movement is executed according to the principles of **ACTION FRONT**, with the following modifications: After uncoupling, the trail is turned 90° away from the direction of fire, and the piece is run forward sufficiently to clear the track made by the truck; articles unloaded from the truck will be placed on the ground so as to clear the track made by the truck.

■ 15. **COUPLING.**—*a.* The pieces being in position and in march order, the command is: **COUPLE**. The trucks, under the command of the first sergeant, approach the position from the right (left) flank. As each truck approaches its piece, it turns to the left (right) and halts in prolongation of the trail of the piece.

b. All cannoneers working together under the direction of the chief of section load the tools, accessories, and unexpended ammunition. Then Nos. 2 and 5 hasten to the trail handles. The gunner releases the brakes. The truck, upon signal from the chief of section, is maneuvered backward until the pintle is almost over the lunette. Nos. 2 and 5, assisted by No. 3 at the muzzle, raise the trail, swing the lunette to the traveling position, and place it over the pintle. No. 2 latches the pintle. All cannoneers take their posts (par. 8).

SECTION VI

PREPARATION FOR ACTION AND MARCH ORDER

■ 16. **TO PREPARE FOR ACTION.**—*a.* The carriages being in position, uncoupled, the command is: **PREPARE FOR ACTION**. Duties of individuals are as follows:

(1) *Chief of section.*—(*a.*) Supervises the work of the cannoneers.

(b) Inspects the matériel, paying special attention to the recoil mechanism (par. 44); when the operations have been completed, reports to the executive, "Sir, No. (so and so) in order," or reports any defects which the section cannot remedy without delay.

(2) *Gunner*.—(a) Assists No. 1 in removing the breech cover.

(b) Removes the panoramic sight from the sight case and secures it on the sight bracket.

(c) Traverses the piece to the center of traverse, sets the deflection at zero and the site at 300, and centers the bubble.

(d) Assists No. 1 in raising and securing the top shield.

(e) Receives the lanyard from No. 4 and lays it on the axle.

(f) Sets the brakes.

(g) Takes his post.

(3) *No. 1*.—(a) Assisted by the gunner, removes the breech cover and places it on the top shield on the right.

(b) Unlocks the traveling locks and lowers the piece apron.

(c) Operates the breech mechanism, examines the breech-block and bore; sets the safety lock at *fire*; leaves the breech open.

(d) Assisted by the gunner, raises and secures the top shield.

(e) Sets the range at 3,000.

(f) Takes his post.

(4) *No. 2*.—(a) Places the trail handspike in the firing position.

(b) Runs around the right of the piece, removes the muzzle and open-sight covers, takes the breech cover from the top shield, and places all covers to the left of the piece.

(c) Removes the sponge-and-rammer staff from the traveling position, assembles it, and places it with the sponge on the breech and muzzle covers.

(d) Distributes waste to the cannoneers.

(e) Takes his post.

(5) *No. 3*.—(a) Places the fuze setter in position.

(b) Sets the fuze-setter scales at corrector 30, range 3,000.

(c) Assisted by No. 4, arranges the ammunition and tools in an orderly and convenient manner to the left of the piece.

(d) Takes his post.

(6) No. 4.—(a) Gives waste to No. 2 for distribution to the cannoneers.

(b) Passes the lanyard to the gunner and the quadrant to the chief of section.

(c) Puts a round of shrapnel in the fuze setter.

(d) Assists No. 3 in arranging ammunition and tools.

(e) Takes his post.

(7) No. 5.—(a) Assembles the aiming stakes and places them beside the sponge-and-rammer staff, or sets out the aiming stakes when so directed by the chief of section.

(b) Takes his post.

b. The coupled pieces may be partially prepared for action before reaching the firing position. The duties of the cannoneers are the same as when the pieces are uncoupled, but only such operations as are practicable are carried out before the pieces are uncoupled. Immediately after establishing the piece in position, preparation for action is completed without command and the cannoneers take their posts for firing the piece.

c. If PREPARE FOR ACTION has not been ordered before the pieces are established in the firing position, the command habitually is given by the chief of section as soon as the piece has been uncoupled for action. In case this is not desired, the caution, "Do not prepare for action," must be given.

■ 17. POSTS OF THE CANNONEERS, PIECES UNCOUPLED.—a. The pieces having been uncoupled, posts are taken as follows:

(1) *Chief of section.*—The chief of section goes where he can control the service of the piece, hear commands, and perform his duties effectively. A convenient post is 2 yards from the end of the trail, on the side opposite the executive.

(2) *Gunner.*—Immediately in rear of the cannoneer's seat, on the left of the trail of the piece.

(3) *No. 1.*—Immediately in rear of the cannoneer's seat, on the right of the trail of the piece.

(4) *No. 2.*—Two feet in rear of the gunner, covering him.

(5) No. 3.—Two feet to the left of and on line with No. 2.

(6) No. 4.—Two feet in rear of No. 3, covering him.

(7) No. 5.—Two feet in rear of No. 2, covering him.

b. At drill, all stand at attention at their posts (fig. 3), facing the front. In firing and in combat, minor modifications of these posts are required for the more efficient performance of the duties in the service of the piece and to secure the protection afforded by the matériel. Higher-numbered cannoneers, if present, take posts as prescribed by the chief of section.

c. In order to exercise the cannoneers in all the duties connected with the service of the piece and to lend variety to the drill, the posts of individual cannoneers should be changed frequently.

■ 18. MARCH ORDER.—*a. Duties of individuals.*—The pieces being uncoupled and prepared for action, to resume the order for marching, the command is: MARCH ORDER. Duties of individuals are as follows:

(1) *Chief of section.*—(a) Supervises the work of the cannoneers.

(b) Inspects the matériel; makes sure that the piece is *not left loaded*; and, when the operations have been completed, reports to the executive, "Sir, No. (so and so) in order," or reports any defects which the section cannot remedy without delay.

(2) *Gunner.*—(a) Places the piece in the center of its traverse and lowers the breech to the traveling position.

(b) Sets the sight scales at zero.

(c) Removes the panoramic sight, returns it to the sight case, and locks the case.

(d) Lowers the shank and secures it.

(e) Removes the lanyard and passes it to No. 4.

(f) Assists No. 1 in raising and securing the piece apron, in replacing the breech cover, and in lowering and securing the top shield.

(g) Releases the brakes.

(h) Takes his post.

(3) *No. 1.*—(a) Closes the breech and sets the safety lock at **SAFE**.

(b) Sets the range scale at zero.

(c) Locks the piece in the traveling position.

(d) Assisted by the gunner, raises and secures the piece apron, replaces the breech cover, and lowers and secures the top shield.

(e) Takes his post.

(4) *No. 2.*—(a) Secures the trail handspike in the traveling position.

(b) Replaces the sponge-and-rammer staff in the traveling position.

(c) Places the breech cover on the top shield and replaces the muzzle and open-sight covers.

(d) Takes his post.

(5) *No. 3.*—(a) Sees that any fuzes which have been set are set back at safe.

(b) Returns unused fuzes to the fuze box.

(c) Sets the fuze setter at corrector 30, range 3,000.

(d) Replaces the fuze setter in the box.

(e) Assisted by No. 4, prepares ammunition and tools for loading into the truck. *He will assure himself that all fuzes have been set at safe.*

(f) Takes his post.

(6) *No. 4.*—(a) Gets the lanyard from the gunner and the quadrant from the chief of section.

(b) Assists No. 3 in preparing ammunition and tools for loading into the truck.

(c) Takes his post.

(7) *No. 5.*—(a) Secures the aiming stakes.

(b) Assists No. 3 in preparing ammunition and tools for loading into the truck.

(c) Takes his post.

b. To resume fire in another position.—(1) If it is intended to resume firing shortly, but in another position, so that the coupling of the pieces is necessitated, the command **MARCH ORDER** is not given. In this case, at the command for coupling, only such of the operations incident to march order are performed as are necessary for the movement of the piece and for the care and security of the equipment.

(2) If the command MARCH ORDER is given while the pieces are coupled, the operations pertaining to march order are completed as described in *a* above.

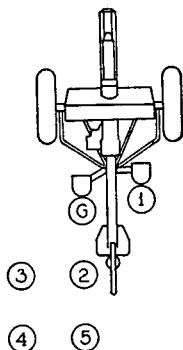


FIGURE 3.—Posts of the cannoneers, piece uncoupled.

SECTION VII

DUTIES IN FIRING

■ 19. GENERAL.—*a*. In general, the duties in firing are as follows:

(1) The chief of section is responsible that all duties are properly performed, all commands executed, and all safety precautions observed.

(2) The gunner sets the announced site and deflection; he lays, refers, and fires the piece.

(3) No. 1 sets the announced range and opens and closes the breech.

(4) No. 2 loads the piece.

(5) No. 3 operates the fuze setter and screws fuzes in shell.

(6) No. 4 prepares ammunition and passes rounds to No. 2 for loading; in time fire he keeps rounds in the fuze setter and sets the fuze.

(7) No. 5 gives general direction to the piece.

b. The duties of the gunner and Nos. 1, 2, and 5 are mutually dependent. The same is true of Nos. 3 and 4.

■ 20. CHIEF OF SECTION.—*a. Enumeration of duties.*—(1) Assisted by the gunner and No. 1, to lay for elevation when the gunner's quadrant is used.

(2) To measure the elevation.

(3) (a) To measure the minimum quadrant elevation.

(b) To measure the minimum range.

(4) To indicate to the gunner the aiming point, the referring point, or the target.

(5) To follow fire commands.

(6) To indicate when the piece is ready to fire.

(7) To give the command to fire, except when firing at moving targets with direct laying.

(8) To report errors and other unusual incidents of fire to the executive.

(9) To conduct prearranged fire schedules.

(10) To record basic data.

(11) To observe and check frequently the functioning of the matériel.

(12) To assign duties when firing with reduced personnel.

b. Detailed description of certain duties.—(1) *To lay for elevation when the gunner's quadrant is used.*—(a) The chief of section is first taught to read settings on the gunner's quadrant and then to set the elevations announced. To set an elevation on the gunner's quadrant, for example 361.8 mils, the chief of section sets the upper edge of the head of the index arm opposite the 360 mark of the graduated arc on the quadrant frame and slides the slide level along the index arm until its index is opposite the 1.8 mark of the scale on the index arm. Care must be taken in setting the slide to use the scale on the index arm which is on the same side of the quadrant as the graduated arc on the frame which was used in setting the index arm at 360 mils. After the slide has been set, the clamp is tightened just sufficiently to hold the slide in place.

(b) The command QUADRANT (SO MUCH) indicates that the gunner's quadrant is to be used.

(c) The announced elevation having been set on the gunner's quadrant, the piece loaded, and the breechblock closed, the chief of section places the quadrant on the quadrant seat on the breech, with the word "LINE OF FIRE" at the bot-

tom and the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale which he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the quadrant seat, parallel to the axis of the bore. It is important that he take the same position and hold the quadrant in the same manner for each subsequent setting, so that the quadrant bubble will in each case be viewed from the same angle.

(d) The chief of section causes the gunner to set the site at 300 (when the required elevation permits) and to center the bubble of the angle-of-site level by manipulating the elevating handwheel. No. 1 then manipulates the range crank until the quadrant bubble is centered, *being careful that the last motion of the bubble is from front to rear.*

(2) *To measure the elevation.*—At the command MEASURE THE ELEVATION, the piece having been laid, the chief of section sets the slide level of the index arm of the gunner's quadrant at zero and places the quadrant on the quadrant seat on the breech as in laying for elevation ((1) above). He then moves the index arm until the bubble passes to the end of the vial away from the hinge of the index arm. He then slowly lowers the index arm until the bubble just passes to the end of the vial toward the hinge. He then allows the index arm to engage the arc and slides the level along the index arm until the bubble is accurately centered. He then removes the quadrant and reads and announces the elevation thus set, for example, "Elevation, No. (so and so), (so much)."

(3) *To measure the minimum elevation or minimum range.*

(a) 1. *Elevation.*—The command is: MEASURE THE MINIMUM ELEVATION. The chief of section, sighting along the lowest element of the bore, causes the gunner to operate the elevating mechanism until the line of sight just clears the crest. He then measures the quadrant elevation as described in (2) above and reports the angle read from the gunner's quadrant to the executive,

thus, "Minimum elevation, No. (so and so), (so much)."

2. *Range*.—The command is: MEASURE THE MINIMUM RANGE, SITE (SO MUCH). The chief of section causes the gunner to set the site announced and to center the bubble of the angle-of-site level by operating the elevating hand-wheel. Sighting along the lowest element of the bore, he then causes No. 1 to operate the range mechanism until the line of sight just clears the crest. No. 1 then reads the range setting, and the chief of section reports this range as the minimum range to the executive, thus, "Minimum range, No. (so and so), (so much), site (so much)."

(b) When the executive announces the corrected minimum elevation or the corrected minimum range and site, the chief of section records it in a notebook and causes the gunner to chalk it on the shield.

(4) *To indicate to the gunner the aiming point, the referring point, or the target*.—Whenever an aiming point, a referring point, or a target has been designated by the executive, the chief of section will make sure that he has properly identified the point in question. He will then indicate it to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the sight until the horizontal and vertical hairs are on the point designated.

(5) *To follow fire commands*.—The chief of section will follow the fire commands mentally. He will not repeat the commands, but will be prepared to give any element of the last command to any cannoneer who has failed to hear it.

(6) *To indicate when the piece is ready to fire*.—When arm signals between the chief of section and the executive can be observed, the chief of section will extend his right arm vertically as soon as the gunner has called "Ready," as a signal to indicate that the piece is ready to fire. When arm signals cannot be observed, the chief of section reports orally to the executive, "No. (so and so) ready."

(7) *To give the command to fire*.—When the gunner can see arm signals made by the chief of section, the chief of

section will give the command to fire by dropping his right arm sharply to his side. When arm signals cannot be used, the command NO. (SO AND SO) FIRE will be given orally. *The chief of section will not give the signal or command to fire until all the cannoneers are in their proper places. He will require the cannoneers to stand clear of the piece for the first round.*

(8) *To report errors and other unusual incidents of fire to the executive.*—If for any reason the piece cannot be fired, the chief of section will report promptly to the executive that fact and the reason therefor; for example, "No. (so and so) out, misfire." Whenever it is discovered that the piece has been fired with an error in laying, the chief of section will report that fact at once; for example, "No. (so and so) fired with incorrect deflection." Whenever the gunner reports that the aiming stakes are out of alinement with the sight, the chief of section will report that fact and request instructions (par. 31). Likewise, other unusual incidents that affect the service of the piece are promptly reported by the chief of section.

(9) *To conduct prearranged fire schedules.*—Whenever the execution of prearranged fires is ordered, the chief of section will conduct the fire of his section in strict conformity to the schedules prescribed.

(10) *To record basic data.*—Data of a semipermanent nature will be recorded in a notebook by the chief of section. This includes such data as minimum elevations; base deflections, including aiming points used; prearranged fires when prepared schedules are not furnished; safety limits in elevation and deflection; number of rounds fired, with the date and hour; and calibration corrections when appropriate.

(11) *To observe and check the functioning of the matériel.*—The functioning of all parts of the matériel will be observed closely during firing. Before the piece is fired, the chief of section verifies the fact that the recoil cylinder contains the proper amount of oil and thereafter carefully observes the functioning of the recoil system. Any evidence of trouble (par. 44) is reported promptly to the executive.

(12) *To assign duties when firing with reduced personnel.*—Whenever the personnel of the section serving the piece is temporarily reduced in numbers below that indicated in this manual, the chief of section will make such redistribution of duties as will best facilitate the service of the piece.

■ 21. GUNNER.—*a. Enumeration of duties.*—(1) (a) To set or change the deflection.

(b) To apply the deflection difference.

(c) To set the angle of site.

(d) To lay for direction.

(e) To lay for elevation.

(f) To call "Ready."

(g) To fire the piece.

(h) To refer the piece.

(i) To record base deflection.

(j) To measure a deflection.

(k) To measure an angle of site.

(l) To use the rammer.

(2) For indirect laying without the gunner's quadrant, the gunner performs duties prescribed in (1) (a), (b), (c), (d), (e), (f), and (g) above.

(3) For indirect laying with the gunner's quadrant, the gunner performs duties prescribed in (1) (a), (b), (d), (e), (f), and (g) above.

(4) For direct laying, the gunner performs duties prescribed in (1) (a), (d), (e), and (g) above.

(5) When directed, the gunner performs duties prescribed in (1) (h), (i), (j), (k), and (l) above.

b. Detailed description of certain duties.—(1) *To set or change the deflection.*—(a) *To set the deflection.*—The gunner is first taught to read deflections set on the sight and then to set the deflections announced. At the command, for example, DEFLECTION 1,885, the gunner first sets the zero of the azimuth micrometer opposite the fixed azimuth index if it is not already so set. He then pushes the throw-out lever with his left hand and with his right hand turns the rotating head until the hundreds' graduation (18 in this case) is opposite the azimuth-circle index. He then releases the throw-out lever and, grasping the azimuth-worm

knob with his left hand with the thumb on top, turns the azimuth-worm knob to the left until the micrometer index is opposite the graduation 85 of the counterclockwise graduations on the azimuth micrometer. The line of sight will then make a horizontal angle of 1,885 mils with the axis of the bore. The azimuth micrometer is then turned until its zero graduation is opposite the micrometer index. Any movement of the azimuth micrometer does not change a deflection previously set.

(b) *To change the deflection.*—The gunner should be trained always to grasp the azimuth-worm knob with his left thumb on top, as the command for changing the deflection then will indicate the direction in which he should move his thumb in turning the azimuth-worm knob. He also should be taught that turning the azimuth-worm knob to the right decreases the deflection set on the sight and results in moving the muzzle to the right when the piece is laid with the new deflection. Similarly, turning the azimuth-worm knob to the left increases the deflection and results in moving the muzzle to the left when the piece is laid. The deflection having been set at 1,885 mils, if a subsequent command be, for example, RIGHT 65, the gunner turns the azimuth-worm knob by moving his thumb to the right until the micrometer index has moved from zero to 65 on the clockwise graduations of the azimuth micrometer. As turning the azimuth-worm knob to the right decreases the deflection, the resulting deflection will be 1,820 mils. The azimuth micrometer is then reset with its zero opposite the micrometer index. Should the command be LEFT (SO MUCH), the deflection setting is changed in a similar manner, except that the gunner moves his thumb to the left and follows the counterclockwise graduations of the azimuth micrometer.

(2) *To apply the deflection difference.*—(a) The command is: ON NO. (SO AND SO) OPEN (CLOSE) (SO MUCH). The gunner of the piece indicated in the command does not change the deflection set on his sight. Each of the other gunners changes his sight setting by the number of mils specified in the command if his piece is next in line to the piece indicated; by twice this number of mils if his piece is second in line from the piece indicated; by three

times this number of mils if his piece is third in line from the piece indicated.

(b) If the command is, for example, ON NO. 1 OPEN 5, the gunner on No. 1 makes no change; the gunner on No. 2 turns the azimuth-worm knob by moving his thumb to the left, *away from the piece indicated in the command*, and sets off 5 mils once; the gunner on No. 3 turns the azimuth-worm knob in a similar manner, except that he sets off 5 mils twice, a total of 10 mils; the gunner on No. 4 also turns his azimuth-worm knob in a similar manner except that he sets off 5 mils three times, a total of 15 mils.

(c) Should the command be, for example, ON NO. 3 CLOSE 10, the gunner on No. 1 turns the azimuth-worm knob by moving his thumb to the left, *toward the piece indicated in the command*, and sets off 10 mils twice, a total of 20 mils; the gunner on No. 2 turns his azimuth-worm knob in a similar manner, except that he sets off 10 mils once; the gunner on No. 3 makes no change; the gunner on No. 4 turns his azimuth-worm knob by moving his thumb to the right and sets off 10 mils once.

(d) It should be noted that, in making the deflection changes involved in applying the deflection difference, each gunner turns the azimuth-worm knob by moving his thumb away from the piece indicated if the command is OPEN, and toward the piece indicated if the command is CLOSE; also that the muzzles of the pieces will be moved in similar directions when the pieces are laid after the deflection difference has been set.

(e) In training gunners to apply the deflection difference, it will be found advantageous to teach them to use the sight as a mechanical adding machine. For example, if the command is ON NO. 1 OPEN 8, the gunner on No. 4 first sets off 8 mils, then after an imperceptible pause another 8 mils, and so on until he has set off 8 mils three times. This method requires no mental arithmetic.

(f) When a deflection change and a deflection difference are announced at the same time, for example, RIGHT 30, ON NO. 1 CLOSE 5, both of which affect the gunner's piece, he will first set off the deflection change and then apply the deflection difference.

(g) In the methods described above, it is implied that the gunner resets the azimuth micrometer with its zero opposite the micrometer index each time the azimuth-worm knob has been turned. By so doing, each change in the deflection setting is made by starting with the micrometer index at zero. This facilitates setting off the tens and units on the azimuth-micrometer scales. It is important that the gunner, before turning the azimuth-worm knob, verify the setting of the azimuth micrometer to make sure that its zero coincides with the micrometer index.

(h) Another method is authorized, as follows: The zero of the azimuth micrometer is left opposite the fixed azimuth index at all times. Deflection changes are made in the proper direction by turning the micrometer index through the required number of graduations, the only difference being that the movement of the index does not always start at zero.

(i) Irrespective of which method is used, all gunners in a battery should be required to use the same method.

(3) *To set the angle of site.*—The gunner is first taught to read angle-of-site settings, and then to set announced angles of site. To set an angle of site, the gunner turns the micrometer drum with his right hand until the number of hundreds announced is opposite the index of the angle-of-site scale and the number of tens and units is opposite the index of the micrometer. In setting the angle of site, it is necessary for the gunner to incline his head and shoulders to the left to enable him to look squarely at the angle-of-site scale.

(4) *To lay for direction.*—(a) *Direct laying.*—The deflection having been set, the gunner traverses the piece by turning the traversing handwheel until the vertical hair of the panoramic sight is on his part of the target. If the amount of movement necessary to lay on the target is greater than can be obtained by traversing, the trail must be shifted. To shift the trail, the gunner commands or signals MUZZLE RIGHT (LEFT). No 5 at the handspike (par. 26), sighting along the line of metal, points the piece directly at the target (except when firing by individual sections at fast-moving targets, as prescribed in par. 29), and the gunner

brings the vertical hair of the sight on the target by means of the traversing handwheel.

(b) *Indirect laying.*—The deflection having been set, the gunner brings the vertical hair of the sight on the aiming point either by traversing the piece or by shifting the trail and traversing the piece. To shift the trail, the gunner commands or signals MUZZLE RIGHT (LEFT). No. 5 shifts the trail as indicated by the gunner until the vertical hair of the sight is approximately on the aiming point. The gunner then completes the laying by operating the traversing handwheel until the vertical hair of the sight is on the aiming point.

(c) *Procedure to insure accuracy.*—To take up lost motion, the final movement of the traversing handwheel should be such as to cause the vertical hair of the sight to approach the aiming point from the left. The gunner should habitually lay with the vertical hair of the sight on exactly the same portion of the aiming point or target for each round.

(5) *To lay for elevation.*—(a) *Direct laying.*—The range having been set, the gunner lays for elevation with the sight by manipulating the elevating handwheel until the horizontal hair of the sight is at the base of the target.

(b) *Indirect laying.*

1. *Without the gunner's quadrant.*—The angle of site and the range having been set, the gunner turns the elevating handwheel until the bubble of the angle-of-site level is centered. He keeps the bubble centered throughout the firing. The last movement of the handwheel must be such that the bubble moves from front to rear. In centering the bubble, the gunner must be careful to look squarely at it.

2. *With the gunner's quadrant.*—See paragraph 20b (1).

(c) *In all cases of laying for elevation, the last movement of the elevating handwheel must be in the direction of depression so as to raise the breech, thereby taking up any lost motion in the elevating mechanism.*

(6) *To call "Ready."*—The piece having been laid for direction and elevation, and No. 1 having called "Set," the

gunner verifies the laying, moves his head clear of the sight, and calls "Ready," to indicate that his piece is ready to be fired.

(7) *To fire the piece.*—At the chief of section's command NO. (SO AND SO) FIRE, the gunner grasps the firing lever and pulls it straight to the rear. *Under no circumstances will the gunner grasp the firing lever until No. 1 calls "Set."* Ordinarily the piece is fired with the gunner and No. 1 seated on the seats; if the chief of section gives the command STAND CLEAR, the gunner and No. 1 step clear of the wheels and, at the command or signal FIRE, the gunner leans forward and fires the piece, using the lanyard. The chief of section may caution, "With the long lanyard." In this case, after all the cannonéers are clear, the gunner attaches the long lanyard to the firing lever, steps clear, and fires as previously described. The gunner detaches the long lanyard immediately after each round is fired. *In case of a misfire, the instructions contained in paragraph 38 will be followed.*

(8) *To refer the piece.*—The piece having been laid for direction, to refer the piece, the command is: 1. AIMING POINT (SO AND SO), 2. REFER. Without disturbing the laying of the piece, the gunner brings the vertical hair of the sight on the new aiming point (referring point). He then reads and announces the deflection thus set, and records the deflection and the referring point on the shield. Two referring points usually are used, one for day and another for night. A referring point should be at least 50 yards from the sight, preferably to the left rear. Frequently it will be necessary to use the aiming stakes as referring points, particularly for night use.

(9) *To record base deflection.*—At the command RECORD BASE DEFLECTION, the gunner records the deflection set on his sight upon the shield or upon a data board (par. 40).

(10) *To measure a deflection.*—The command is: 1. AIMING POINT (SO AND SO), 2. MEASURE THE DEFLECTION. The piece having been established in direction, the gunner turns the sight until the vertical hair is on the aiming point. He then reads and announces the deflection.

(11) *To measure an angle of site.*—The command is: 1. TARGET (SO AND SO), 2. MEASURE THE SITE. The piece having been laid on the target for direction, the gunner, using the elevating handwheel, brings the horizontal hair of the sight to the base of the target and centers the bubble of the angle-of-site level by changing the angle-of-site setting. He then reads and announces the angle of site.

(12) *To use the rammer.*—The rammer is used to extract unfired rounds or cartridge cases which cannot be ejected by the extractor. *The sponge and rammer will be handled by the gunner only.* To extract a cartridge case which cannot be ejected by the extractor, the bottom of the inside of the case is tapped lightly until it is loosened and can be pushed out of the chamber. No. 2, standing at the breech, receives the cartridge case in both hands. To extract an unfired round, the procedure prescribed in paragraph 37 will be followed.

■ 22. No 1.—*a. Enumeration of duties.*—(1) To set the range.

(2) To open and close the breech.

(3) To call "Set."

b. Detailed description of certain duties.—(1) *To set the range.*—No. 1 is first taught to read range settings on the graduated range drum, and then to set ranges. To set a range, No. 1 grasps the range crank handle with his right hand and turns it until the graduation announced is opposite the index. He is first taught to set off ranges to the nearest hundred and then to the nearest twenty-five. To take up lost motion, the last motion in setting the range should be in the direction of decreasing range.

(2) *To open and close the breech.*—(a) *To open the breech.*—No. 1 grasps the operating lever handle with the left hand and compresses the lever latch. He then draws the lever to the rear and right, swinging the block to the right. The lever must be drawn sharply so as to give the ejector sufficient force to throw the cartridge case out of the breech. *As soon as the breech is open, No. 1 looks through the bore to see that it is clear.* He will see that the block remains fully away from the breech so that it will not

interfere with loading the piece. In firing, No. 1 half rises from his seat, leans to the rear, and opens the breech as the gun returns into battery.

(b) *To close the breech.*—No. 1 places the middle of the palm of his open left hand against the operating lever, pushes the lever to the left, and swings the block smartly to its seat.

(c) *Opening and closing the breech.*—When No. 1 understands the functioning of the breech mechanism, Nos. 1 and 2 are instructed in loading and unloading the piece. The drill cartridges used for this instruction must be in good condition. To avoid damaging the cartridges when they are ejected, a mat or similar cushion should be placed at the point where they fall. If full-weight drill cartridges are used, No. 2, standing at the breech, receives the ejected round with both hands.

(3) *To call "Set."*—When No. 1 has completed his duties in laying the piece and closing the breech, he calls "Set."

■ 23. No. 2.—*a. Enumeration of duties.*—(1) To load the piece.

(2) In volley fire, to call out the number of the round.

(3) When necessary, to assist No. 5 in giving direction to the piece.

b. Detailed description of certain duties.—(1) *To load the piece.*—To receive the round, No. 2 steps with his left foot toward No. 4 and grasps the round with his right hand at the base of the cartridge case and his left hand in rear of the ogive. He then resumes his position facing the gunner and inserts the round in the breech, removing his left hand. He pushes the round home with his right hand. When about one-third of the cartridge case still extends beyond the breech face, he gives the round a final impetus until his open hand comes in contact with the breech, then continuing the motion he rotates his hand upward and to the left, clearing the breech. No. 2 will be particularly careful to avoid striking the fuze against any portion of the matériel. To prevent premature bursts caused by projectiles being struck on the fuze by the piece in recoil, a round to be loaded will be held well out of the path of recoil of the gun until the latter is again in battery. (AR 750-10.)

(2) *To call out the number of the round.*—To insure that the correct number of rounds is fired in volley fire, No. 2 calls out the range and number of the round as he loads the piece; and, as he loads the last round, adds "Last round." For example, when two rounds are to be fired at 2,800, he calls out, "2,800 one; 2,800 two, last round." He should not speak louder than necessary to insure his being heard by the members of his own gun squad.

■ 24. No. 3.—*a. Enumeration of duties.*—(1) To set the fuze setter.

(2) To set fuzes.

(3) To fuze shell.

(4) To remove fuzes from shell.

b. Detailed description of certain duties.—(1) *To set the fuze setter.*—(a) The series of fire commands for initially opening fire with time-fuzed projectiles will contain the data to be set on the fuze setter. These commands are, for example, CORRECTOR 28, 3,600. For subsequent rounds, the corrector setting is increased (decreased) at the command UP (DOWN) (SO MUCH).

(b) No. 3 is first taught to read data set on the fuze setter and then to set data announced. To set data on the bracket fuze setter, No. 3 turns the corrector-worm knob with his right hand until the graduation on the corrector scale, corresponding to the corrector announced, is opposite the fixed index. He then turns the range-worm crank until the graduation on the range scale, corresponding to the range announced, is opposite the fixed index.

(c) To set data on the hand fuze setter, No. 3 turns the corrector-worm knob until the graduated line on the corrector scale, corresponding to the corrector announced, is in coincidence with the index engraved on the rim of the case. He then turns the knob on the range-scale worm until the graduation on the range scale, corresponding to the range announced, is in coincidence with the index on the index bar.

(d) If the range to be set on the fuze setter differs from that to be set on the piece, the command FUZE RANGE (SO MUCH) will be given. In this case No. 3 sets the fuze range

on the fuze setter, disregarding the range announced for the piece.

(e) If the command PERCUSSION is given, the fuze setter is not used. However, No. 3 keeps the range scale of the fuze setter set according to the ranges announced. He is thus ready to pass to time fire as soon as a corrector is announced.

(f) To insure accuracy in setting the scales of the fuze setter, it is necessary that No. 3 look squarely at the scales and their indexes. To take up lost motion, the final movement of the scales should always be in a counterclockwise direction.

(g) The fuze data having been set on the fuze setter, No. 3 calls "Cut" as a signal to No. 4 to set the fuze.

(2) *To set fuzes.*—No. 3 sets fuzes only when the hand fuze setter is used. The fuze data having been set on the fuze setter as indicated above, to set the fuze, the projectile being held by No. 4, No. 3 places the fuze setter over the fuze. The fuze setter is then turned in the direction indicated by the arrow on the fuze-setter case until the slot in the range-ring carrier engages the pin on the graduated time-train ring of the fuze. The guide plate and the range-ring carrier will then bear firmly on the fuze. No. 3 continues to turn the fuze setter in the direction indicated until the stop pin attached to the corrector-scale support engages with the fixed stop pin on the fuze and prevents further motion. When the fuze has been properly set, the pointer which is attached to the top of the corrector scale will register with the graduated line on the closing cap of the fuze. The fuze setter is then removed.

(3) *To fuze shell.*—At the command SHELL, No. 3 opens the fuze box and places it in a convenient position. The projectile being held by No. 4, No. 3 inserts the designated fuze, being careful to note that it is fitted with its felt or rubber washer, and screws it home by hand. The fuze is given its final seating by the use of the fuze wrench. No great force should be used. If there is any difficulty in screwing the fuze home, the fuze should be removed and another inserted. If the same trouble is experienced with the second fuze, the shell should be rejected.

(4) *To remove fuzes from shell.*—If for any reason a projectile which has been fuzed is not to be fired, the fuze will be removed. The operation of inserting a fuze is reversed. If the adapter starts to unscrew with the fuze, the unscrewing must be stopped at once and the shell disposed of as directed by the executive.

■ 25. No. 4.—*a. Enumeration of duties.*—(1) To remove ammunition from the containers and to clean and prepare it for firing.

(2) To set the fuze when the bracket fuze setter is used.

(3) To hold the round while No. 3 sets the fuze, when the hand fuze setter is used.

(4) To hold the round while No. 3 screws the fuze into the shell.

(5) To pass the round to No. 2.

b. Detailed description of certain duties.—(1) *To remove ammunition from the containers and to clean and prepare it for firing.*—No. 4, when time permits, arranges the rounds so that they are within easy reach by partially removing them from their packing containers before firing begins. He inspects the projectile to see that it is free from sand and dirt and that the rotating band is not burred. Any foreign matter will be removed by wiping with a piece of waste. Projectiles having burred rotating bands should be placed aside temporarily until the burs can be removed with a file.

(2) *To set the fuze when the bracket fuze setter is used.*—When the command CORRECTOR (SO MUCH) is given, No. 4 procures a round of shrapnel, removes the waterproof cap of the fuze, and inserts the point of the projectile in the bracket fuze setter, taking care that the lug nearest the point of the fuze engages in the groove in the fuze setter. When No. 3 has called "Cut," No. 4 turns the projectile with a steady and uniform motion in a clockwise direction until further movement is stopped. In turning the projectile, No. 4 stands to the rear of the fuze setter facing to the right front. His left hand, back down, grasps the round at or near the forward end of the cartridge case. The palm of the right hand is placed on the base of the cartridge case, the fingers grasping the edge of the base. While turning the projectile, No. 4

takes care to hold it firmly against the guide and to keep the fuze well engaged by a steady pressure on the base of the cartridge case with the right hand. No. 4 then removes the round by lifting it directly out of the fuze setter, taking care not to strike the lugs of the fuze against any part of the fuze setter. The time of burning may be read from the graduated ring of the fuze. When directed by the chief of section, No. 4 will read and announce the time of burning after setting the fuze. A time fuze which has been set for any desired time of burning can be reset to *S* (Safe) by setting the fuze-setter range ring to *S*, the corrector to normal (30), and resetting the fuze. The fuze should be inspected to see that the *S* on the graduated time ring of the fuze is in line with the marks on the upper time-train ring and on the body of the fuze. Fuzes set but not fired will be reset to *S* (Safe), inspected, and returned to the container by No. 4. If the command PERCUSSION is given, No. 4, after removing the waterproof cap, passes the round directly to No. 2 for loading.

(3) *To hold the round while No. 3 sets the fuze, when the hand fuze setter is used.*—No. 4 holds the round while No. 3 sets the fuze. No. 4 procures the round, removes the waterproof cap, and partially kneels on the right knee. He places the base of the cartridge case on his right thigh just above the knee. He grasps the round with both hands, the right arm resting on his right thigh, the left arm braced against his left thigh. The round is held firmly, pointing upward in the general direction of No. 3's head, while No. 3 sets the fuze.

(4) *To hold the round while No. 3 screws the fuze into the shell.*—When shell is being used, No. 4 holds the round while No. 3 screws in the fuze. The round having been removed from the container, cleaned, and prepared for firing, No. 4 removes the fuze plug from the fuze socket and holds the round firmly with its nose pointing in the general direction of No. 3's head while No. 3 screws in the fuze.

(5) *To pass the round to No. 2.*—No. 4 passes rounds to No. 2 in the most expeditious manner and in such a way that No. 2 is enabled to grasp the base of the cartridge case with his right hand.

■ 26. No 5.—*a. Enumeration of duties.*—(1) To shift the trail.

(2) To keep empty cartridge cases out of the way.

b. Detailed description.—(1) *To shift the trail.*—When laying for direction involves shifting the trail, the gunner and No. 5 work together. To shift the trail, No. 5 stands immediately in rear of the trail handspike, feet about 18 inches apart, and grasps the handspike with both hands. The gunner causes the trail to be shifted by the command MUZZLE RIGHT (LEFT), or other suitable indication, until the vertical hair of the sight is approximately on the target (aiming point). When direct laying is used, the top shield is lowered, and No. 5 sights along the line of metal and shifts the trail so as to point the piece directly at the target. In the case of direct laying on moving targets (except when firing by individual sections at fast-moving targets as prescribed in par. 29), No. 5, at the command TARGET (SO AND SO), points the piece directly at the target, but does not shift the trail again until the gunner commands or signals MUZZLE RIGHT (LEFT).

(2) *To keep empty cartridge cases out of the way.*—No. 5 takes the cases as they are ejected and throws them well to the rear of the piece.

SECTION VIII

ADDITIONAL INFORMATION ON THE SERVICE OF THE PIECE

■ 27. ACCURACY IN LAYING.—Sighting and laying instruments, fuze setters, and elevating and traversing mechanisms will be manipulated so as to minimize the effects of lost motion. This requires that the last motions in setting instruments and in laying be always in the directions prescribed. To insure accurate laying, the gunner and any other cannoneers who have duties in connection with laying the piece invariably will be required to verify the laying after the breech has been closed. When the piece must be established on uneven ground, the amount of cant of the axle is measured with the gunner's quadrant by placing the quadrant on the top center edge of the main shield, and reported by the chief of section to the executive.

■ 28. FIRE AT WILL.—*a.* The piece being in position and prepared for action, in case of sudden attack, when the target appears at a range of less than 500 yards, the executive may command: 1. TARGET (SO AND SO), 2. FIRE AT WILL. The chief of section repeats this command.

(1) No. 1 sets the range at 500; No. 3 sets corrector 30, range zero; No. 4, if shrapnel is used, sets fuzes continuously. The gunner, assisted if necessary by No. 5 at the handspike, keeps the piece laid directly on his portion of the target throughout the firing.

(2) Firing is commenced at the command of the chief of section NO. (SO AND SO) FIRE. The piece is loaded and fired as rapidly as possible until the command CEASE FIRING, or until the enemy disappears from view or actually reaches the piece.

b. In fire at will, refinements of laying are not attempted, rapidity of fire being of primary importance. Shrapnel, if available, will be used. If shrapnel is not available, shell, preferably with delay fuze, will be used. In general, the procedure in firing shell is the same as with shrapnel, except that the gunner lays well below the lowest visible element of the target.

■ 29. TO FIRE BY INDIVIDUAL SECTIONS WITH DIRECT LAYING AT MOVING TARGETS.—*a.* The chief of section observes the target, estimates its range and speed, and gives such directions to the cannoneers as will aid them in laying and firing the piece.

b. The gunner traverses the piece to the center of its traverse and, when directed by the chief of section, sets a lead in mils for the target on the panoramic sight. Assisted by No. 5 at the handspike, who points the piece directly at the target, the gunner manipulates the elevating and traversing mechanisms until the vertical and horizontal hairs of the sight intersect at the target. The piece is fired by the gunner when the piece is laid, No. 1 has called "Set," and the chief of section has indicated that the executive has given the command or signal to commence firing. Subsequent rounds are fired by the gunner as soon as the necessary corrections have been made and he again is laid on the target.

c. If the target is moving rapidly in a lateral direction, the gunner may cause No. 5 to lead the target by pointing the piece ahead of the target. In this case the gunner commands, for example, LEAD RIGHT (LEFT) (SO MANY) MILS. No. 5, using the graduated trail log, float, or shield to measure off the lead ordered (par. 32), points the piece *ahead* of the target by the number of mils announced by the gunner. The gunner fires the piece as the target reaches the intersection of the cross hairs of the sight; if No. 5 has shifted too much, he traverses the piece to meet the target and fires the piece at the appropriate moment. For subsequent rounds, No. 5 shifts the trail by pointing the piece ahead of the target by the announced lead immediately after the piece is fired, until a new lead is announced or firing ceases. In case the target stops or moves to the front or rear, the gunner may require No. 5 to cease leading and point the piece directly at the target. In this case the gunner commands, for example, LEAD ZERO, MUZZLE RIGHT (LEFT). No. 5 ceases to lead the target, shifts the trail in the direction indicated, and points the piece directly at the target.

d. No. 1 sets the range announced by the chief of section, and calls "Set."

e. No. 2 loads the piece at the command or signal to commence firing and continues to load the piece each time it has fired and returned to battery, until the command CEASE FIRING is given.

■ 30. AIMING STAKES.—When a suitable natural aiming point is not visible, the piece, after it has been laid initially for direction, is referred to the aiming stakes as described in paragraph 21. Two aiming stakes are used for each piece. Each stake is equipped with a light for use in firing at night. One stake is set up in a convenient location at least 100 yards from the piece. The other stake is set up at the mid-point between the first stake and the piece, and is lined in by the gunner so that the vertical hair of his sight and the two aiming stakes are all in the same vertical plane. Any lateral displacement of the piece during firing can then be detected easily and corrected for as indicated in paragraph 31. For night use, the lights should be adjusted so that the

far one will appear several feet higher than the near one. The two lights thus will clearly establish a vertical line on which the vertical hair of the sight can be laid.

■ 31. CORRECTION FOR LATERAL DISPLACEMENT.—When the gunner notes that the piece is out of line with reference to the aiming stakes, he reports that fact to the chief of section. The gunner continues to lay the piece, using the far stake, until correction is authorized by the executive. The piece is then moved back into its original position, or a correction is made as follows: The gunner lays the piece by using the far stake, then refers to the near stake, and finally lays on the far stake with the new reading. The stakes are then realigned by moving the near stake. This correction is effective only when the stakes have been equally spaced as indicated in paragraph 30.

■ 32. TRAIL LOGS AND PLATFORMS.—*a.* When soil conditions are unfavorable and the necessary material can be procured, the handling of the piece will be greatly facilitated by the construction and use of improvised wheel mats, trail logs, and platforms.

b. In order to facilitate shifting the trail in fire against moving targets, a trail log should be constructed conforming to the arc described by the spade and permitting shifts of at least 800 mils. A block shaped to provide a smooth bearing surface against the trail log should be fastened to the spade. The trail log should be graduated every 50 mils; the upper part of the shield and the float should also be graduated in mils.

■ 33. REPORTING ERRORS.—Each member of the gun squad should be constantly impressed with the importance of reporting promptly to the chief of section any errors made by members of the gun squad. The chief of section will report errors immediately to the executive as prescribed in paragraph 20.

■ 34. CEASE FIRING.—The command CEASE FIRING normally is given to the gun squad by the chief of section, but in emergencies anyone present may give the command. At this command, *regardless of its source*, firing will cease immedi-

ately. If the piece is loaded, the chief of section will report that fact to the executive. Firing is resumed at the announcement of the range or elevation.

■ 35. **SUSPEND FIRING.**—The command **SUSPEND FIRING** is given only when the battery is firing on a prearranged schedule and a temporary halt in the firing is desired. At this command, firing is stopped, but settings continue to be altered in conformity with the schedule. If the piece is loaded, the chief of section will report that fact to the executive. Firing will be resumed at the command **RESUME FIRING**.

■ 36. **CHANGES IN DATA DURING FIRING.**—The announcement to the gun squad of any new element of firing data serves as a signal to stop all firing *previously ordered but not yet executed*. If the piece is not loaded at the announcement of a new element of firing data, the new data will be set off and firing resumed at the announcement of the range or elevation. If the piece is loaded with shrapnel and the new data require a change in the fuze setting, the piece will be unloaded (par. 37). If no change in fuze setting is involved, or if the piece is loaded with shell, the new data are set off and the firing is resumed.

■ 37. **TO UNLOAD THE PIECE.**—*a.* When the command **UNLOAD** is given, No. 1 opens the breech, and No. 2, standing at the breech, receives the ejected round with both hands. In case the extractor fails to eject the round, the rammer must be used.

b. The gunner takes the sponge-and-rammer staff and inspects the rammer head to see that it is thoroughly clean and that the recess for the fuze is free from any foreign matter. Under the direct supervision of an officer, he inserts the rammer head in the bore and pushes it carefully in until it incloses the fuze and comes in contact with the projectile. He pushes the rammer head gently against the projectile, and, if necessary, taps the rammer staff lightly to dislodge the projectile. He then pushes the projectile out of the breech while No. 2, standing at the breech, receives the round in both hands.

c. To unload a shell fitted with the M-46 or M-47 type fuze, the special rammer head for handling such fuzes must be used. When practicable, the procedure prescribed in TR 1370-A will be followed.

■ 38. MISFIRES.—In the event of a misfire, at least three attempts to fire the primer will be made. The breechblock will not be opened until at least 2 minutes have elapsed after the last attempt to fire (AR 750-10). Rounds which have misfired will be removed from the firing position and disposed of as prescribed in TR 1370-A.

■ 39. AMMUNITION.—*a.* Ammunition must be protected from damage, especially to rotating bands and cartridge cases. When it is received, it should be sorted into lots and placed in the best available storage. Ammunition data cards should be retained until after all ammunition pertaining thereto is expended. Fuzes must not be stored with other components, and all components should be kept in their waterproof containers until their early use is anticipated. Protection should be provided against moisture, dirt, the direct rays of the sun, and so far as practicable against hostile artillery fire and airplane bombs. Protection against weather, dirt, and sun may be obtained by the use of paulins below and above the ammunition, and suitable dunnage below and between the layers. Protection against hostile fire may be obtained by the use of small dispersed stacks, trenches, or dugouts.

b. Care must be exercised to keep sand and dirt out of the adapter threads of unfuzed ammunition. The fuze wrench must be used to seat fuzes.

c. With HE shell, Mk. I or Mk. IV, or chemical shell, Mk. II, the M-46, M-47, Mk. IV, or Mk. V fuzes may be used.

■ 40. THE SECTION DATA BOARD.—When positions are occupied for more than a few hours, a data board may be used by each section for recording such items as base deflections, calibration corrections when appropriate, minimum range or elevation, data for primary defensive fire missions, and other data the need for which may be urgent.

SECTION IX

CARE AND MAINTENANCE OF MATÉRIEL

■ 41. GENERAL.—*a.* This section covers such operations in the care and maintenance of the matériel as may be performed by a battery in the field.

b. Complete instructions for battery maintenance, including disassemblies, are found in the Handbook of the 75-mm Gun Matériel, M1917 (British), and in Technical Regulations and Standard Nomenclature Lists referred to in paragraph 2. Operations not covered therein are a function of the ordnance maintenance company.

c. In general, the battery is charged with preventive maintenance, that is, with routine cleaning, lubricating, preserving, and adjusting. This also includes certain classes of repairs and replacement of parts which may be made under the supervision of an officer or the chief mechanic. Unless specifically prohibited, parts indicated in SNL C-27 by the symbol % may be drawn and installed by or under the direction of the chief mechanic. For routine care and maintenance, specific duties are assigned to individuals, squads, or sections, and a strict accountability for the proper performance of such duties is enforced.

d. In general, the following disassemblies may be performed within the battery:

- (1) Barrel assembly from cradle.
- (2) Breech and firing mechanism.
- (3) Recoil mechanism, including dismounting of outer spring case from cradle.
- (4) Shields.
- (5) Elevating mechanism, except elevating screw.
- (6) Crosshead assembly and traversing screw.
- (7) Axletree assembly and axle brackets.
- (8) Wheels.
- (9) Brake mechanism.
- (10) Lunette assembly.
- (11) Trail assembly.
- (12) Operations necessary for the replacement of worn or broken parts as listed in SNL C-27.

■ 42. CLEANING AND LUBRICATING.—*a.* Dirt and grit accumulated in traveling or from the blast of the piece in firing settle on the bearing surfaces, and in combination with the lubricant form a cutting compound. Powder fouling attracts moisture and hastens the formation of rust. Dirt on nonbearing surfaces can usually be removed by water; lubricated or other greasy parts must be cleaned with dry-cleaning solvent applied with a brush or rag. The following cleaning materials are issued by the Ordnance Department for use in the field:

(1) *Soda ash* (dehydrated sal soda).—Used for cleaning the bore, breech mechanism, and firing mechanism after firing.

(2) *Dry-cleaning solvent*.—For removing grease. It is preferred to kerosene because it does not leave a corrosive film, and to gasoline because it is less inflammable.

(3) *Crocus cloth*.—This is the coarsest abrasive permitted for cleaning rust and stains from bearing surfaces.

(4) *Emery cloth*.—Used for cleaning unfinished or *non-bearing* steel surfaces only. Issued in five degrees of coarseness, of which 00 is the finest.

(5) *Burlap, jute*.—Used for cleaning the bore.

(6) *Cotton waste, clean rags, and sponges*.—For general cleaning purposes.

b. A division of duties for members of the gun squad in routine cleaning and maintenance is as follows:

(1) The gunner—the sights and all sighting equipment including the gunner's quadrant.

(2) Nos. 1 and 2—The breechblock and the bore. No. 1 will clean and oil the range gear.

(3) No. 3—the fuze setter.

(4) Nos. 4 and 5—the elevating and traversing mechanisms, the gun slides, and the cradle guideways.

(5) Higher-numbered cannoneers assist in the operations as directed by the chief of section.

c. Before firing, at lulls during firing, and immediately after firing, the piece should be cleaned and lubricated. At other times it should be cleaned and lubricated at intervals not exceeding 2 weeks, depending upon its use and its condition. The bore, breech mechanism, and firing mechanism

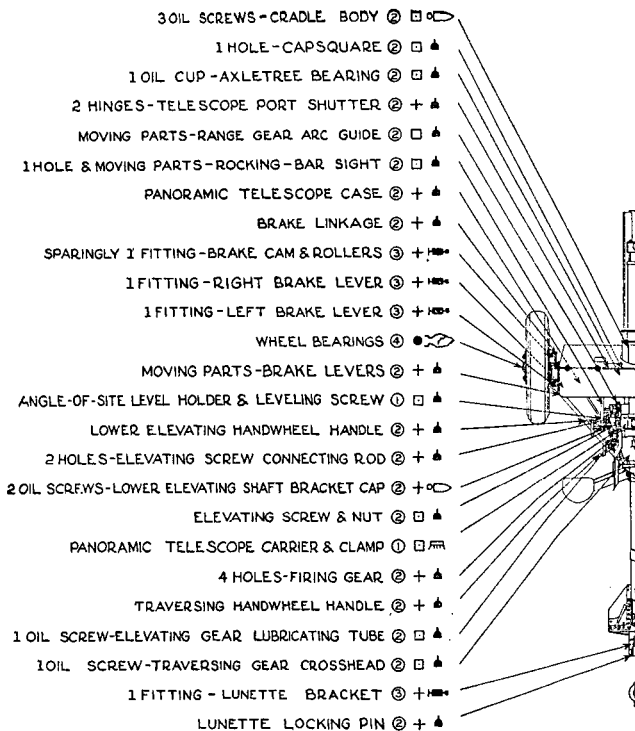
should be cleaned as described in paragraph 45. The cleaning and lubricating of the recoil mechanism are described in paragraph 44. Emphasis should also be placed on the proper cleaning, drying, and lubricating of the slides, elevating and traversing mechanisms, trunnions, sighting and laying mechanisms, and the unpainted bearing surfaces.

d. To facilitate identification, all oil holes and grease fittings should be made conspicuous by circling with bright red enamel.

e. Lubrication instructions for the gun and carriage, M1917A1, are covered in figure 4. While being lubricated, parts should be exercised to insure complete and even distribution of the lubricant. After immersion by passing through water, the wheel bearings must be cleaned and repacked with fresh grease. Other parts of the carriage may require more frequent lubrication as a result of particularly adverse conditions.

■ 43. PROTECTION AGAINST CHEMICALS.—Whenever chemical attacks are anticipated, all bright parts should be covered with oil. After a gas attack, the oil must be wiped off and fresh oil applied. If mustard or other persistent gas is used, absorbent objects may be deeply contaminated, and even hard surfaces may be dangerous for 6 to 8 days if the chemical is not neutralized. Surfaces should be sprinkled with calcium hypochlorite or chloride of lime, or painted with a whitewash made from either. After 2 to 6 hours the lime is washed off and the matériel rinsed thoroughly with water. When large quantities are available, warm (but not boiling) water should be used instead of calcium hypochlorite or chloride of lime. In all cleaning operations, the gas mask and special gasproof gloves must be worn. All cleaning rags, sticks, etc. are disposed of by *burying*. They must not be burned, as the heat will disseminate dangerous vapor.

■ 44. RECOIL MECHANISM.—a. *General*.—The heavy low-pour-point recoil oil as issued by the Ordnance Department should be used in the recoil cylinder. It is especially important that this oil be kept free of dirt and water, and that it be not mixed with other oils. The capacity of the recoil cylinder without gravity tank is 5½ pints, or with a gravity



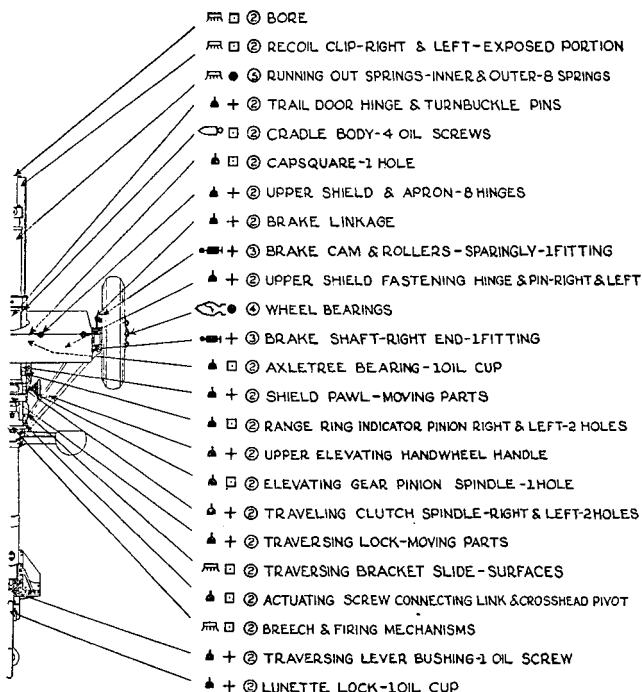
LUBRICANTS

- ① NEUTRAL OIL
- ② LUBRICATING OIL - USE LIGHT (SAE-20) WHEN TEMPERATURE IS BELOW 50°F. OR HEAVY (SAE-50) WHEN ABOVE 50°F.
- ③ MINERAL LUBRICATING GREASE
- ④ FIBER WHEEL BEARING GREASE
- ⑤ GRAPHITE LUBRICATING GREASE

HOW APPLIED

- ▲ OILER
- OIL GUN
- PRESSURE LUBRICATING GUN
- BRUSH OR CLOTH
- HAND PACKING

FIGURE 4.—Lubrication



WHEN APPLIED

□ DAILY DURING CONSTANT SERVICE, OTHERWISE EVERY TWO WEEKS

+ EVERY TWO WEEKS

● EVERY SIX MONTHS

NOTES-(a) Elevating gear brackets-packed by Ordnance

(b) Immediately before firing and during lulls in firing clean and oil bearing and sliding surfaces of breech, firing, sighting, elevating and traversing mechanisms and cradle.

(c) After firing or washing, lubricate bore, breech and firing mechanisms, exposed gears, rocking-bar sight, telescope carrier, and unpainted bearing or sliding surfaces.

chart, 75-mm gun, M1917A1.

tank, 7.8 pints. In case of an *emergency*, alternative liquids may be temporarily used in the recoil cylinder as follows:

- (1) Pure glycerine or a mixture of glycerine and water.
- (2) Any heavy lubricating oil.
- (3) Soapy water, or water containing a proportion of soda.
- (4) Clear water may be used in a great emergency only, but for no longer than is absolutely necessary.

b. Periodic or repair operations.—Essential operations which should be performed on this recoil mechanism to insure proper functioning are as follows:

(1) *Care or replacement of running-out springs.*—Every 6 months or oftener the running-out springs should be removed, cleaned with dry-cleaning solvent, and inspected for evidence of breakage, undue corrosion, or permanent set. The normal free length of an inner spring is 18.58 inches and of an outer spring 19.65 inches. Any spring, inner or outer, found with a permanent set of $1\frac{1}{4}$ inches or more below the normal free length should be replaced. Running-out springs should be coated with graphite lubricating grease at the time of assembly.

(2) *Care of outer-spring case.*—Each time the recoil mechanism is disassembled the interior of the outer-spring case should be thoroughly cleaned with dry-cleaning solvent, dried, inspected for burs, wear, etc., and coated with graphite lubricating grease.

(3) *Inspection and replacement of packing rings.*—The packing rings should be frequently inspected and replaced if found defective.

c. Operations prior to firing.—(1) The recoil mechanism should be inspected for undue oil leakage. Four holes are bored near the rear end of the inner-spring case, and two holes are bored underneath the outer-spring case, one at the front and the other at the rear, in order to afford a means of detecting leaks in the gland.

(2) The recoil-cylinder packing rings should be carefully examined and changed if defective. When a packing ring is being tightened, the gland should not be screwed home, metal to metal, in the stuffing box. At least four threads of the gland must be engaged. If the packing cannot be made tight without metal-to-metal contact, a fresh

packing must be used or an additional thin ring packing inserted. Spare packing rings soaked in tallow should be kept ready for immediate use.

(3) The recoil cylinder should be correctly filled. If time permits after filling and before any oil is drawn off, the filling-hole plug at the top rear of the cylinder should be kept out for about 15 minutes, after which the cylinder should again be examined to see that it is properly filled.

(4) To insure free operation of the recoil mechanism, the gun slides and cradle guideways must be clean, properly lubricated, and free from burs.

d. Operations during firing.—(1) The recoil cylinder should be examined from time to time to see that it is full.

(2) As often as opportunity permits, the gland should be examined and, if necessary, screwed up when the recoil cylinder is hot from firing. The packing is then very plastic and easily squeezed to make a good joint.

(3) The chief of section constantly verifies the complete return of the piece to battery. He also insures that the gun slides and cradle guideways are kept properly lubricated, and that the recoil cylinder is not leaking. In the case of malfunctioning he takes such action as is indicated below:

Malfunction	Cause	Correction
Oil leaking from opening in spring-case cap.	(1) Gland not properly screwed up. (2) Gland packing failing to make good joint.	(1) Remove piston-rod nut and outer spring case cap. Screw up the gland, using No. 122 spanner. Replace cap and nut. (2) Insert additional ring or replace packing with new packing.
Recoil too short.	(1) Stuffing-box gland too tight. (2) Excess oil in recoil system (recoil in this case will be violent). (3) Dirty or damaged slide.	(1) Examine packing; if screwed up too tight, unscrew the gland as far as necessary without causing oil to leak; if oil leaks, replace packing. (2) Drain out a small quantity of oil. (3) Clean and examine slide. If damaged, repair slide. If repairs cannot be made by battery mechanics, send to ordnance maintenance company for repair.

Malfunction	Cause	Correction
Recoil excessive.	(1) Insufficient oil in recoil cylinder (due to leakage at stuffing box). (2) Weak or broken spring. (3) Front flange of inner-spring case broken.	(1) Fill the system with oil. Drain off $\frac{1}{10}$ pint. Tighten or renew the stuffing-box packing. (2) Replace spring. (3) Send to ordnance maintenance company for repair.
Counterrecoil slow. Gun fails to return to battery.	(1) Dirty, scored, or dry slide. (2) Stuffing box gland too tight. (3) Weak or broken counterrecoil spring. (4) Front flange of inner-spring case broken. (5) Gun slides or guide-way distorted.	(1) Repair (if necessary), clean with dry-cleaning solvent, dry and lubricate. (2) Unscrew as far as necessary without causing oil to leak. Repack, if oil leaks. (3) Replace the spring. (4) Send to ordnance maintenance company for repair. (5) Send to ordnance maintenance company for repair.
Gun returns to battery with shock.	(1) Insufficient oil in recoil system. (2) Worn counterrecoil buffer.	(1) Refill. Drain off $\frac{1}{10}$ pint. (2) Have new buffer fitted by ordnance maintenance company.

■ 45. BARREL ASSEMBLY, BREECH MECHANISM, AND FIRING MECHANISM.—*a. General.*—(1) Gun slides are examined, cleaned, and lubricated by pulling the gun to the rear until three-fourths of the slide is exposed. Burs or rough spots may be removed with a fine file or oilstone. The slides should be washed with dry-cleaning solvent and wiped dry. The slides should always be lubricated before returning the gun to battery.

(2) Especial care must be exercised to prevent damaging the surface of the quadrant seats. Any repair of the quadrant seats must be made by ordnance personnel.

(3) When necessary to use a hammer in disassembly, one of copper should be used. If a steel hammer must be used, a copper drift or hardwood block should be interposed between the hammer and the metal parts of the barrel assembly, breech mechanism, or firing mechanism.

b. Operations during firing.—(1) During firing all exposed bearing surfaces must be kept clean and covered with a thin film of lubricating oil.

(2) Whenever the rate of firing permits, the bore should be swabbed with clean water and a sponge.

(3) When shells burst near the gun, the chief of section should make sure before firing that neither the exterior nor the muzzle face of the bore have been struck by fragments.

(4) The gun slides should be examined, cleaned, and lubricated frequently.

(5) The causes and correction of malfunctioning of the breech and firing mechanisms are given in the following table:

Malfunction	Cause	Correction
Fails to discharge when proper percussion on primer is obtained (misfire).	Defective primer.	See paragraph 38.
Fails to discharge until after several percussions on primer (primer struck weakly).	(1) Firing mechanism not working freely. (2) Weak or broken firing spring. (3) Firing pin or rebound block pin burred or otherwise deformed.	(1) See paragraph 38. Disassemble firing mechanism and examine all parts for burrs or roughened surfaces. Remove burrs or rough spots with a fine file or oilstone. Clean all parts with dry-cleaning solvent. Dry thoroughly and lubricate. (2) Replace with new firing spring. (3) Remove burrs or roughened surface with fine file or oilstone. If deformed, replace.
Fails to extract cartridge case.	Broken or damaged extractor.	See paragraph 37. Replace extractor.
Breechblock does not rotate freely.	(1) Insufficient lubrication; dirt or grit in threads of breech recess. (2) Burrs or roughness on threads of breechblock, breech recess, or carrier.	(1) Clean the block and recess with dry-cleaning solvent; wipe dry and lubricate. (2) Clean block and recess as in (1) above. If burrs or roughness are found, they should be removed with a fine file or oilstone. (No portion of the threads should be cut away to remove a crack. In this case, the ordnance maintenance company should make repair.)

c. Operations after firing.—(1) As soon as possible after firing, the breechblock and firing mechanism should be disassembled, and all parts cleaned and lightly oiled.

(2) The barrel assemble should be retracted until three-fourths of the slide is exposed in order to clean and oil the slides thoroughly. All residue resulting from firing should

be removed, using dry-cleaning solvent when necessary, and the slides should be dried and lightly coated with lubricating oil.

(3) The bore, breech mechanism, and firing mechanism are washed with a solution of $\frac{1}{2}$ pound of soda ash or 1 pound of sal soda in 1 gallon of water. Cleaning the bore is accomplished by means of a swab of burlap stitched around the end of the rammer staff. No attempt should be made to remove copper fouling. When all powder fouling has been removed, the bore should be swabbed with clear water and then wiped dry. Finally, it should be lightly coated with lubricating oil, either light or heavy depending on the weather. The process may have to be repeated on successive days if there is evidence of sweating. If the piece is not to be kept in constant service, the bore should be slushed with rust-preventive compound instead of oil.

■ 46. WHEELS AND BRAKES.—*a. General.*—The care and maintenance of the wheel mechanism, including tires and brakes, is a function of the battery. Tire pressure should be maintained at 25 pounds. Excessive wear may result if the piece is not locked securely in traveling. Tires should be removed at least once a year and the disk and rim cleaned and painted. Every 6 months, or oftener, if necessary, the wheel hubs should be removed, the old grease flushed out, new grease pressed into the bearings and the hub by hand, and the wheel bearings adjusted. Whenever the wheel hubs are immersed in water or there is a possibility of the wheel bearing grease being washed out of the bearings, the wheels must be removed and the bearings and hub cleaned, dried, and repacked with fresh grease. The proper adjustment and operation of the brake mechanism should frequently be checked.

b. Test of wheel bearing adjustment.—At all halts during marching, the wheel hubs should be felt for overheating. During the march the wheels should be observed to ascertain that they are running true, without side play. When the bearings are adjusted, the adjustment should be checked by placing a bar between the raised tire and the ground, at the same time holding one finger on the cage of the outer

bearing. When in working the bar up and down a barely perceptible shake is felt, and the wheel will rotate when given a slight spin, the adjustment is correct.

c. Bearing adjustment.—To adjust a wheel bearing, the carriage is jacked up, the hub cap removed, the cotter pin extracted from the wheel spindle, and the adjusting nut tightened until it binds, while the wheel is being rotated slowly. The nut is then backed off until the wheel rotates freely but without side play (one-sixth to one-fourth turn). The bearing adjustment should be tested and, when correct, the cotter pin and hub cap should be reassembled.

d. Brake mechanism.—The brakes are adjusted by means of brake adjusting wedges which are turned clockwise to tighten. Prior to adjusting the brake mechanism, the wheel bearing should be checked for proper adjustment and the brake mechanism lubricated. All parts of the brake linkage must operate positively and freely but without excessive lost motion. At all times, lubrication of the brake cam and rollers must be held at the correct amount to prevent grease from contacting the brake lining. The procedure for adjustment is as follows:

- (1) Set the brake lever at the full released position.
- (2) Jack up the wheel.
- (3) Adjust the wedge until a drag is felt on the wheel, then back off just enough so the brake does not drag. Brakes must be cold when being adjusted.
- (4) The position of the brake lever is adjusted by changing the effective length of the brake rod.

■ 47. MISCELLANEOUS PARTS OF CARRIAGE.—*a. Trunnions.*—Routine cleaning of the trunnions may be accomplished by removing the cap squares. To remove the cap squares, the top carriage is traversed as far to the left as it will go to permit the right cap key being removed, and to the right to remove the left key. Periodically, the barrel assembly should be removed and the trunnions, bearings, and cap squares thoroughly cleaned and lubricated.

b. Elevating gear.—In replacing the bearings and elevating nuts, the open side of the bearings is inserted first in the upper gear and the closed side first in the lower gear

(with the teeth of the elevating nuts at the top in both cases). When the bearings are properly assembled, the gun is elevated by revolving the handwheels toward the rear.

c. Yards and degrees scale ring.—All parts should be kept clean, free from grit, burs, or dents, and the revolving surfaces lightly oiled. In replacing the eccentric bushing in the arc guides, there should be the least possible play between the teeth of the pinion and the elevating arc. The grooves in the eccentric bushing which engage the stop pin are arranged to give eight adjustments, which are numbered 1 to 8. There are two patterns of bushings, the maximum setting on one being represented by the number 8 and the other by the number 5. The order of adjustment for each pattern bushing is as follows:

	Nos. 1 and 8, minimum and maximum	Nos. 1 and 5, minimum and maximum
First adjustment.....	1	1
Second adjustment.....	2	2
Third adjustment.....	3	8
Fourth adjustment.....	4	3
Fifth adjustment.....	5	7
Sixth adjustment.....	6	4
Seventh adjustment.....	7	6
Eighth adjustment.....	8	5

d. Traversing gear.—The pivot of the cross head should be kept properly screwed up, and any lateral play in the traversing screw adjusted by tightening the crosshead cap and the check nut. Friction surfaces should be kept clean and lightly lubricated.

■ 48. SIGHTING AND FIRE-CONTROL EQUIPMENT.—*a. General.*—Battery personnel are forbidden to disassemble the panoramic telescope, but tests and adjustments should be made in the presence of an officer as hereinafter described. Only those tools provided by the Ordnance Department should be used. In general, the sights are correct—

(1) *In direction*, if the deflection scales read zero when the line of sighting is in a plane parallel to the vertical plane passing through the axis of the bore.

(2) *In elevation*, if the algebraic sum of the range and site settings indicates the same angle above the horizontal that is measured with an accurate gunner's quadrant on the tube.

(3) If there is no excessive lost motion between the sights and the tube.

b. Testing equipment.—Equipment used in testing sights consists of bore sights and a gunner's quadrant. The target for bore-sighting may be a distant terrain object, more than 1,000 yards away, or a test target for use in close proximity. In the latter case the displacement of the axis of sighting from the axis of the bore must be correctly shown. The panoramic telescope displacement is 8 inches to the left of the axis of the bore. The displacement in elevation is adjustable, being 15.25 inches above the axis of the bore when the carrier is in its lowest position and site is 300. The rocking-bar sight displacement is 14 inches to the left of and 8.25 inches above the axis of the bore. An aiming stake with a wooden block or marker attached makes a suitable test target. In direction tests this test target may be canted as the carriage is canted, making cross leveling of the tube unnecessary. Tests can be made without the issue bore sights by sighting through the firing pin recess or through a brass cartridge case with the primer removed, using improvised cross hairs at the muzzle.

c. Test of the gunner's quadrant.—To test the gunner's quadrant, set the scales at zero, place it on the quadrant seat of the piece, and center the quadrant bubble by means of either elevating handwheel. Then reverse the quadrant on its seat. The bubble should center itself. If it does not, it should be adjusted at the earliest opportunity by the Ordnance Department. If it must be used, apply a correction in the appropriate sense equal to one-half of the measured error determined in the end-for-end test.

d. Panoramic telescope, M6.—The panoramic telescope is a delicate instrument and must not be subjected to rough usage, jars, or strains. When not in use, it is kept in the special case provided on the shield. Dirt should be removed from optical surfaces by brushing lightly with a camel's-hair brush. Oil or grease should be removed by applying

alcohol, or, if alcohol is not available, by breathing on the glass and then wiping lightly with lens paper or a clean, soft cloth. The ordnance maintenance company packs the worms and gears at the annual overhaul; ordinarily, no further lubrication is required. The following tests and adjustments should be made, the telescope being firmly clamped in the shank of the carrier:

(1) *Test for direction* (vertical cross hair).—(a) Level the gun tube transversely by means of the gunner's quadrant and a straightedge applied across the recoil clips.

(b) Bore-sight on the target with range *zero*, using the lower elevating handwheel for any necessary elevation changes. (Do not move the upper elevating handwheel as this will alter the relation between the line of sighting and the axis of the bore.)

(c) Turn the vertical hair of the telescope to the target, using the azimuth micrometer of the telescope. Take the reading.

(d) The readings should be *zero* on both the azimuth (window) scale and the micrometer scale. If the micrometer scale does not indicate *zero*, loosen the micrometer set screw, turn the micrometer to zero without disturbing the vertical hair, and then tighten and recheck. If the azimuth-window index does not indicate *zero*, loosen the four set screws and move the index. Tighten and recheck.

(2) *Test for elevation* (horizontal cross hair).—(a) Level the gun tube transversely.

(b) Set the angle-of-site scale at 300 and center the bubble with the lower elevating handwheel (angle-of-site handwheel).

(c) Bore-sight on the target, using the upper elevating handwheel (range handwheel).

(d) Measure the elevation of the tube with the gunner's quadrant.

(e) Place the horizontal hair of the telescope on the appropriate part of the target (*b* above), using the elevation-micrometer knob of the telescope.

(f) Read the elevation and micrometer scales on the head of the telescope.

(g) Reading in (f) above should equal that in (d) above plus 300. If it does not, loosen the elevation-micrometer knob locking screw, and without disturbing the horizontal hair turn the scale to the proper setting. Tighten and recheck.

e. Angle-of-site scale and elevation scales.—(1) Set site 300.

(2) Center the angle-of-site bubble by means of the *lower elevating handwheel*, making the last motion of the breech upward.

(3) Lay the gun horizontal by means of the gunner's quadrant, using the *upper elevating handwheel*, making the last movement of the breech upward.

(4) The meter and mil scale rings should read zero. If not, remove the cotter pin from the end of the spindle, loosen the nut of the jamming plate and turn the scale ring to zero by hand. Tighten and recheck.

f. Rocking-bar sight for alinement.—(1) Level the gun transversely.

(2) Set the rocking-bar sight on zero deflection.

(3) Bore-sight on the target.

(4) The rocking-bar sight should be on the appropriate part of the target. If not, loosen the clamping screw below the foresight and screw the acorn of the sight up or down until the sight is correct. Tighten and recheck. (There is no adjustment for deflection error.)

g. Adjustment of the bracket fuze setter, M1916.—(1) To eliminate looseness in either worm gear loosen the set screw and with a screwdriver turn the adjusting plug clockwise. Retighten the set screw. The range crank should not fall of its own weight.

(2) To eliminate end play in either worm shaft remove the crank handle or knob by driving out the tapered pin, loosen the set screw, and tighten the bearing cap with the teat wrench provided. Retighten the set screw. Replace the handle or knob.

